Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC704-Antenna and Wave propagation

7th Semester, 2017-18 (Odd Semester)

Course (catalog) description

This course introduces the concepts and definitions of fundamentals of antenna and its design.

Compulsory/Elective course : Compulsory
Credit & Contact hours : 3 & 45
Course Coordinator : Dr.E.Kanniga

Instructors :

Name of the instructor	Class handling	Office location	Office Phone	Email (domain:@ bharathuniv.ac.in	Consultation
Dr.E.Kanniga	FINAL Year ECE	SA block		kanniga.etc@bharathuniv.ac.in	9.00-9.50 AM
Mr.R.S.Sidharth Raj	FINAL Year ECE	SA block			12.45-1.15 PM

Relationship to other courses:

Pre –requisites **:** Electromagnetic Fields and waves.
Assumed knowledge : The students will have a physics background obtained at a high school (or equivalent) level.

Following courses : Application related subjects Mobile Communication and satellite Communication

Syllabus Contents

UNIT I BASIC ANTENNA CONCEPTS 9

Radiation Patterns, Beam solid angle, radiation intensity, Directivity, effective aperture, Antenna field zones, Polarization, impedance, cross field, Poynting vector. Friis Transmission formula, Duality of Antennas, Antenna and Transmission line, Radiation from a dipole antenna, Antenna temperature System temperature.

UNIT II POINT SOURCES **9**

Definition, Power patterns, Array of two point sources – Pattern multiplication, Broad side array, End fire array, n-isotropic array, Evaluation of null directions and maxima, Amplitude distributions. Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array

UNIT III SMALL ANTENNAS: **9**

Half wave dipole antenna radiated fields of short dipole, small loop and helical Antenna, monofilar-multifilar helix. Radiation resistance, Directivity and Design Feature. Half wave dipole: radiated fields and other feature. Numerical tool for antenna analysis

UNIT IV SPECIAL ANTENNAS: **9**

Yagi uda Antenna, Tumstile antenna, Principle of frequency independent antennas –Spiral antenna, helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, rhombic antenna, Horn antenna, Reflector antennas and their feed systems, Micro strip antenna, Impedance and antenna measurements;

UNIT V WAVE PROPOGATION: **9**

Ground wave propagation, Troposphere wave, wave- tilt of the surface wave, Ionosphere propagation – effective permittivity and Conductivity of ionized gas, Reflection – Refraction of waves from ionosphere, regular – irregular variation of Ionosphere, earth magnetic field, Faraday rotation, wave propagation in the Ionosphere. Duct propagation, Critical frequency and Space propagation,

Total: 45 Periods

Text Books

1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, *"Antenna and Wave Propagation",* Tata McGraw Hill, 4th Edition, 2010.
2. R.L.Yadava, *"Antennas and Wave Propagation",* PHI, 2011

References

1. Constantine A.Balanis, *"Antenna Theory: Analysis and Design",* Third Edition, John Wiley and Sons, 2012.
2. G.S.N. Raju, *"Antennas and wave propagation",* 1st Edition Pearson Education, 2012.
3. Robert S. Elliott, *"Antenna Theory and Design",* John Wiley and Sons, Revised Edition, 2007.
4. www.studynama.com/.../229-Antenna-wave-propagation-(AWP)-pdf-eb.
5. A.R.Harish, M.Sachidanada, "Antennas and Wave propagation", Oxford University

Computer usage: Used simulation too RFSIM99 to do analysis

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area: ***Antenna and Wave Propagation*** | Electronics | Transmission Lines and Networks | **Electromagnetic Fields and waves**

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems. This course emphasizes:	Correlates to program outcome		
	H	M	L
1. To develop an understanding of the fundamental laws and elements of antenna	a,c	b,l	l
2. To develop the ability to apply in design	l,k	a,d,g,h	j
3. To understand basic design gain and loss	a	a,c,g,i	B,f,j,l
4. To learn the "antenna parameters''	a,c,i,k	F,k	b,f
5. Introduce students to different methods involves in analysis in virtual design and actual implementation		a,c,g,i	j,l

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
	UNIT I BASIC ANTENNA CONCEPTS		
1.	Radiation Patterns,	No	Chapter 2.4 / page no : 20 Chapter 2.5 / page no : 23 Chapter 2.6 / page no : 25 Chapter 2.10 , 2.13 / page no : 26 , 29 Chapter 2.31 / page no : 60 Chapter 2.34 / page no : 70 Chapter 2.32 , 2.37 / page no : 61 , 79 Chapter 2.35 / page no : 73 Chapter 2.25 / page no : 48
2.	Beam solid angle,	Yes	
3.	radiation intensity,	No	
4.	Directivity, effective aperture,	Yes	
5.	Antenna field zones,	Yes	
6.	Polarization,	No	
7.	impedance, cross field,	Yes	
8.	Pointing vector.	Yes	
9.	Friis Transmission formula,	Yes	
10.	Duality of Antennas,	No	Chapter 2.26 / page no : 50
11.	Antenna and Transmission line,	Yes	Chapter 2.64 / page no : 20
12.	Radiation from a dipole antenna,	No	
13.	Antenna temperature System temperature.	No	Chapter 17.2 / page no : 774
	UNIT II POINT SOURCES		
14.	Definition, Power patterns,	No	Chapter 3.1 , 3.2 / page no : 86 , 87 Chapter 4.2 / page no : 118 4.3, 4.6 / page no: 127, 137. Cha2.64c / page no: 138. 4.9 / 196 4.7 / 185 Chapter 11.10/page no : 496 Chapter 11.13/page no : 496 Chapter 11.25/page no : 535
15.	Array of two point sources	No	
16.	Pattern multiplication, Broad side array,	No	
17.	End fire array,	No	
18.	n-isotropic array,	No	
19.	Evaluation of null directions and maxima, Amplitude distributions.	Yes	
20.	Concept of Phased arrays,	No	
21.	Adaptive array,	No	
22.	Basic principle of antenna Synthesis-	Yes	
23.	Binomial array	Yes	
24.	Review of arrays	No	Chapter 11
	UNIT III SMALL ANTENNAS		
25.	Half wave dipole antenna	Yes	Chapter 6/page no : 238-264 Chapter 7/page no : 265-338
26.	radiated fields of short dipole,	Yes	
27.	small loop antenna	Yes	
28.	helical Antenna,	Yes	
29.	Monofilar helix.	Yes	

30.	Multifilar helix.	Yes	Chapter 18.5/page no : 824-826 Chapter 5/page no : 200-235
31.	Directivity and Design Feature	Yes	
32.	Radiation resistance,	Yes	
33.	Radiated fields and other feature.	Yes	
34.	Numerical tool for antenna analysis	Yes	
35.	Numerical tool for antenna analysis	Yes	
36.	Design Feature	Yes	
	UNIT IV SPECIAL ANTENNAS		
37.	Yagi uda Antenna,– Impedance and antenna measurements;	Yes	Chapter 15.6/page no : 708-710 Chapter 15/page no : 726 Chapter 16.5/page no : 725-26 Chapter 15.3/page no : 69 Chapter 7/page no: 267–309
38.	Turnstile antenna,	Yes	
39.	Principle of frequency independent antennas	Yes	
40.	Helical antenna,	Yes	
41.	Spiral antenna,	Yes	
42.	Log periodic antennas	Yes	
43.	Modern antennas	Yes	
44.	Re- Active antenna,	Yes	
45.	configurable antenna,	Yes	
46.	Dielectric antennas,	No	
47.	rhombic antenna,	No	
48.	Horn antenna, Reflector antennas and their feed systems, Micro strip antenna,	No	Chapter 13/page no : 624-660
	UNIT V WAVE PROPOGATION		
49.	Ground wave propagation–and Conductivity of ionized gas, Faraday rotation,	No	A.R.Harish, M.Sachidanada, "Antennas and Wave propagation", Oxford University Press, 2007 Page : 330 - 381
50.	Troposphere wave,	Yes	
51.	wave- tilt of the surface wave,	No	
52.	Ionosphere propagation	Yes	
53.	effective permittivity	Yes	
54.	Conductivity of ionized gas,	No	
55.	Reflection – Refraction of waves from ionosphere,	Yes	
56.	earth magnetic field,	Yes	
57.	regular – irregular variation of Ionosphere,	Yes	
58.	Duct propagation,	yes	
59.	Critical frequency and Space	No	
60.	Review of all units	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment /Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Mr R.S.Sidharth Raj Assistant professor , Department of ECE **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate*:*

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement

Course Teacher	Signature
Dr.E.KANNIGA	
Mr.R.S.Sidharth Raj	

Course Coordinator **HOD/ECE**